



September 28, 2016

Ms. Theresa Kirk, Environmental Engineer  
ArcelorMittal Burns Harbor, LLC  
250 West U.S. Highway 12  
Burns Harbor, IN 46304-9745

**Re: Groundwater Sampling and Analysis Plan  
Diesel Fuel Free Product Recovery  
Locomotive and Mobile Equipment Shop**

Dear Ms. Kirk:

**Weaver Consultants Group, LLC** (WCG), has prepared this Sampling and Analysis Plan (SAP) as requested by ArcelorMittal Burns Harbor, LLC (ArcelorMittal). The proposed SAP is based on the information compiled by WCG since free product remediation began in 2009 and comments provided by Peter Ramanauskas of U.S. EPA in his letter to you dated February 19, 2016.

### **Background Information and Purpose**

A subsurface release of diesel fuel was encountered at the location illustrated on **Figure 1** during December 2007. Remediation of soil was completed to the extent practicable as described in our July 31, 2008 report: "Corrective Action Completion Report for Diesel Fuel-Impacted Soil." Because of high groundwater conditions, diesel fuel-impacted soil and residual free product remained at the base of the remedial excavation. Remediation of the residual free product was then performed in follow up to the soil remediation. As you are aware, approximately 1,409 gallons of diesel fuel was recovered through 2Q2015 when we prepared the Progress Report and Termination Request – Corrective Measures for Diesel Fuel Release dated August 7, 2015. This report concluded that remediation was complete to the extent practicable even though up to 4 inches of free product accumulated in remediation well RW-4 when its pump was not operating from during 1Q2015. This basis for the conclusion was that only de minimis (less than 2 gallons per month) quantities were available for recovery during times of operation.

U.S. EPA commented that the system may be shut down during 2016, but should be kept on standby status while the remediation wells are further checked for rebound. If rebound occurs, U.S. EPA commented that the remediation system can be restarted, or that passive recovery, such as absorbent socks, may be used until such time that no free product is observed in the wells for a “period of time.”

U.S. EPA inquired regarding the free product piezometer assessment discussed in the 2008 Corrective Action Completion Report. U.S. EPA indicated that it wanted to know whether areas further downgradient were investigated for the presence of free product or groundwater contamination. In short, no downgradient investigation has been performed to date; beyond that which has already been reported. U.S. EPA inquired as to the number of rounds of groundwater data that were available. One such round is available and as was reported in 2Q2015.

The purposes of this Sampling Analysis Plan (SAP) is to identify proposed piezometer locations and specify sampling and analysis procedures to assess for the presence of free product in areas further downgradient and to assess the underlying groundwater quality for dissolved hydrocarbon impacts.

## **Remediation System Operations and Maintenance**

Active operations were suspended on June 10, 2016 when absorbent socks were installed in remediation wells RW-1 through RW-4. Passive operations include weekly checking of the absorbent socks and wringing them out to recover absorbed diesel fuel.

## **Free Product Piezometer Installation**

WCG proposes to install three additional downgradient piezometers to check for free product and provide groundwater sampling points to the west and northwest of the diesel fuel-impacted area. We anticipate that these will be installed just west of the static rail cars and existing diesel fuel above ground storage tank to the west. These wells will be designated FP-4, FP-5, and FP-6. The existing and proposed piezometer locations and groundwater flow direction are illustrated on **Figure 1**. Similar information is illustrated on **Figure 2** using a recent aerial photograph as a base to establish current surface facilities and conditions.

### ***Monitoring Well Construction and Installation***

Installation of the monitoring wells will be preceded by the advancement of a soil boring using 4.25-inch hollow stem augers. Standard penetration tests will be conducted at continuous 2-ft intervals to recover representative samples of soil for visual examination. WCG will examine the samples in the field and prepare soil boring logs as described in the attached Field Standard Operating Procedure (SOP) **SOP 08-002 (10-17-2015)** for subsurface soil sampling.

Construction of the monitoring wells will be in accordance with 329 IAC 10-21-4. The monitoring well casing will be PVC with a nominal inside diameter (ID) of 2 inches, each to a depth of 18 ft below ground surface (bgs). The pipe will have threaded flush joints and be equivalent to Schedule 40 ASTM standards. The joints will be secured with Teflon tape. No solvents will be used as joining compounds. The casing will terminate in a PVC well screen with continuous wire wound or machine cut 0.010 inch slots, approximately ten percent (10%) openings in screen. The length of the screen will be 10 feet. A cap of the same material as the well screen will be threaded onto the bottom of each well screen to prevent the intrusion of filter material and a removable vented cap will be installed at the top of the riser pipe.

### ***Backfilling/Well Construction***

The annular space of the monitoring wells will have a minimum thickness of 6.0 inches between the casing and the boring wall. The annular space surrounding the well screen will be backfilled with a clean coarse silica sand/fine gravel, which is uniform in size and 3 to 5 times the average 50% retained size of the formation material, from 6 inches below the well screen to a level 1-2 feet above the well screen. An approximate one foot thick layer of fine sand will be installed above the coarse sand/gravel backfill.

All backfilling will be done through a tremie pipe in 2-foot increments or less as the casing or augers are withdrawn to keep the hole from collapsing around the well point before the sand pack chamber is established.

A minimum four (4) foot seal of bentonite, pellets or equivalent, will be placed above the sand pack. Care will be exercised to obtain an adequate bentonite seal as casing or augers are withdrawn.

A high solids bentonite grout will then be tremie placed to within approximately 3 feet of the ground surface. The consistency of the grout will be approved by WCG personnel in the field prior to tremie placement. Alternatively, if above the water table, the remaining annular space may be backfilled with bentonite chips to a depth of 3-4 feet below ground surface. The chips will be installed in-place (i.e., bridging must be avoided) and sufficiently hydrated as they are installed.

A surface seal of concrete will be installed in the remaining borehole annular space. The concrete will extend a minimum of 2 feet away from the well head in all directions and be sloped to drain surface water away from the well head. To provide well security, a locking protective metal casing will be installed around the monitoring well casing and be anchored within concrete below the frost line. A vent hole or vented cap will be placed at the top of the well casing. The annular space between the monitoring well casing and the protective metal casing will be filled with cement to a level at least one inch higher than that of the surrounding apron. A drainage hole will be drilled in the protective metal casing immediately above the cement fill. The remaining space between the monitoring well casing and the protective metal casing will be filled with a fine gravel or coarse sand.

At least two (2) bumper guard posts will be installed around each of the monitoring wells. These are to be 4-inch diameter steel pipe, a minimum of 7 feet long and set in concrete. They will be installed approximately 4 feet below surface grade and have approximately 3 feet of stick-up, and be filled with concrete or sand and capped with concrete.

The Contractor will paint the outer surface of each of the bumper guard posts in a high visibility yellow paint upon completion of the installation activities. The outer surface of the steel protective covers will also be painted either yellow or green.

### ***Well Development***

Upon completion of the monitoring well installation, the wells are to be developed using a submersible pump. Purging will be initiated from the screened portion of the well and be continued until the fluid runs clear. WCG personnel will determine when the well is properly developed. Water removed from the wells during development will be containerized and transported and decanted at a location designated by ArcelorMittal for treatment in its waste water treatment plant.

## Survey Control

At the conclusion of drilling and well installation, WCG will survey the new monitoring wells using the same datum as the existing wells. Horizontal surveying will be performed using a 2-meter handheld GPS unit. Vertical surveying will be performed using an optical auto-level to the nearest 0.01 ft.

## Groundwater sampling and Analysis

Sampling and analysis will include free product piezometers FP-1, FP-4, FP-5, and FP-6. Remediation wells RW-1, RW-2, RW-3, and RW-4 will also be sampled.

Prior to sampling the piezometers and remediation wells, WCG will measure the depth to free product and the depth to water using an electric interface probe. The measurements will be recorded to the nearest 0.01 ft. This data will provide information on groundwater flow direction and apparent thickness of free product at all locations explored.

Groundwater sampling will then be performed using a 12 volt submersible pump to withdraw water from beneath any light non-aqueous phase liquid that might be present. Field and laboratory quality control samples are listed in **Table 2**. Low flow sampling techniques with field stability measuring of pH, temperature, specific conductance, and dissolved oxygen will be performed as specified in the attached field **SOP 08-003 (10-17-15)**. Quality assurance objectives for field measurements are listed in the attached **Table 2**.

The samples will be collected in containers to be provided by ArcelorMittal's NELAC-accredited contract laboratory, Microbac Laboratories of Merrillville, Indiana. Sample containers, preservatives, and allowable holding times are listed in the attached **Table 3**. The samples will be analyzed for the following parameters:

- Benzene, toluene, ethylbenzene, and total xylenes (BTEX) via Method 8260; and,
- Polycyclic Aromatic Hydrocarbons (PAHs) via Method 8270 SIM.

## Data Quality Assessment

The quality of the data collected during the investigation will be assessed as it is developed, qualified if necessary in light of the quality objectives described herein, and then considered in accordance with the objectives of the investigation. Assessment of data quality will consider adherence to established SOPs, verification of results obtained, and overall completeness.

## Schedule

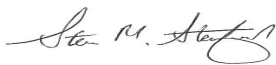
WCG anticipated initiating and completing the services described herein during 4Q 2016.

## Deliverables

Upon completion of the field work and receipt and review of the analytical data, WCG will prepare a written report describing the results of the site investigation. Our report will include, but not be limited to, a narrative description of the work and results obtained, a map illustrating the sampling locations, test results, groundwater flow direction, and apparent thickness of free product (if any), boring logs, a copy of the laboratory's analytical report(s), and our assessment of the data in light of applicable project and data quality objectives.

We appreciate this opportunity to be of service. If you should have any questions or comments concerning this proposal, please do not hesitate to call me at (574) 271-3447.

Very truly yours,  
**Weaver Consultants Group, LLC**



Steven M. Stanford, LPG  
Manager, Granger Environmental Operations

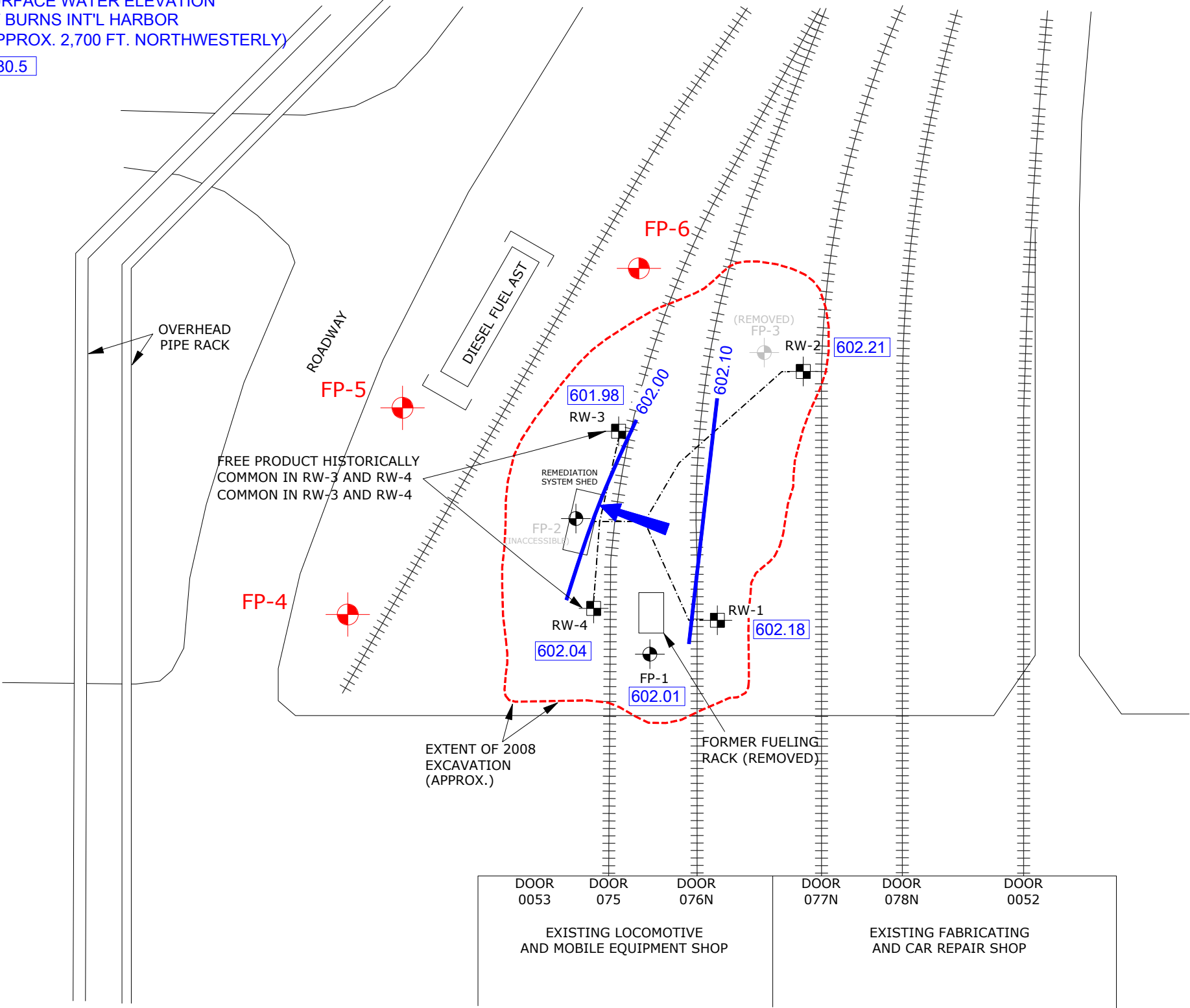
**Attachments:**

Figure 1 – Proposed Piezometer Locations, Potentiometric Surface (5/29/2016)  
Figure 2 – Proposed Piezometer Locations  
Table 1 – Field and Lab QC Sample Requirements  
Table 2 – QA Objectives for Field Measurements  
Table 3 – Sample Container, Preservation and Holding Time Requirements  
Appendix A – Field Standard Operating Procedures (SOPs)

## **FIGURES**



SURFACE WATER ELEVATION  
AT BURNS INT'L HARBOR  
(APPROX. 2,700 FT. NORTHWESTERLY)  
580.5

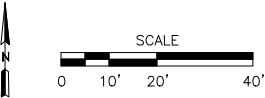


**LEGEND:**

- Free Product Recovery Well
- Free Product Piezometer
- Excavation Extents
- Proposed Piezometer (2016)
- Railroad Track
- Air Supply and Product Discharge Lines Buried 24 to 36 Inches
- 602.52 Observed Groundwater Level Elevation (ft.)
- Inferred Potentiometric Contour
- Groundwater Flow Direction

- NOTES:
1. LAND SURFACE ELEVATION AROUND EXCAVATION IS APPROXIMATELY 614 FEET, MSL.
  2. EXCAVATION FOR CORRECTIVE ACTION OF DIESEL FUEL IMPACTED SOIL EXTENDED TO A DEPTH OF APPROXIMATELY 7 TO 8 FEET BELOW GRADE (EL. 606 – 607).
  3. EXCAVATION WAS BACKFILLED AND RAILROAD TRACKS REPLACED BY 5/7/08.

DOOR 0053	DOOR 075	DOOR 076N	DOOR 077N	DOOR 078N	DOOR 0052
EXISTING LOCOMOTIVE AND MOBILE EQUIPMENT SHOP			EXISTING FABRICATING AND CAR REPAIR SHOP		



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DATE: 9/26/16 FILE: 2387351-04 CAD: FIGURE 3.DWG	DRAWN BY: TAG DESIGN BY: SMS REVIEWED BY: SMS
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PREPARED FOR

**ArcelorMittal**

**Weaver Consultants Group**

**PROPOSED PIEZOMETER LOCATIONS  
POTENTIOMETRIC MAP (5/29/2015)**

DIESEL FUEL FREE PRODUCT REMEDIATION SYSTEM  
NORTH OF LOCOMOTIVE & MOBILE EQUIPMENT SHOP  
ARCELORMITTAL BURNS HARBOR, LLC  
250 WEST U.S. HIGHWAY 12  
BURNS HARBOR, INDIANA

CHICAGO, IL NAPERVILLE, IL SPRINGFIELD, IL	GRANGER, IN GRIFFITH, IN DUBLIN, OH	ST. LOUIS, MO FT. WORTH, TX DENVER, CO
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FIGURE 1

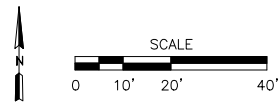
K:\BURNS\CLIENTS\BURNS\TOWN\2387351-04\ARCELORMITTAL\51104 - LOCATIONS\PIEZOMETER PLAN SHEETS\FIGURE 1.DWG



**LEGEND:**

- EXISTING FREE PRODUCT RECOVERY WELL
- EXISTING FREE PRODUCT PIEZOMETER
- PROPOSED PIEZOMETER (2016)
- EXCAVATION EXTENTS
- RAILROAD TRACK
- AIR SUPPLY AND PRODUCT DISCHARGE LINES BURIED 24 TO 36 INCHES

- NOTES:**
1. LAND SURFACE ELEVATION AROUND EXCAVATION IS APPROXIMATELY 614 FEET, MSL.
  2. EXCAVATION FOR CORRECTIVE ACTION OF DIESEL FUEL IMPACTED SOIL EXTENDED TO A DEPTH OF APPROXIMATELY 7 TO 8 FEET BELOW GRADE (EL. 606 - 607).
  3. EXCAVATION WAS BACKFILLED AND RAILROAD TRACKS REPLACED BY 5/7/08.



<input type="checkbox"/> AS-BUILT <input checked="" type="checkbox"/> PROPOSED <input type="checkbox"/> APPROVED FOR CONSTRUCTION <input type="checkbox"/> CLIENT APPROVAL BY: _____	PREPARED FOR  <b>ArcelorMittal</b>	<b>PROPOSED PIEZOMETER LOCATIONS</b>  DIESEL FUEL FREE PRODUCT REMEDIATION SYSTEM NORTH OF LOCOMOTIVE & MOBILE EQUIPMENT SHOP ARCELORMITTAL BURNS HARBOR, LLC 250 WEST U.S. HIGHWAY 12 BURNS HARBOR, INDIANA			
	 <b>Weaver Consultants Group</b>				
DATE: 9/26/16 FILE: 2387351-04 CAD: SHEET2-AB.DWG	DRAWN BY: SMS DESIGN BY: SMS REVIEWED BY: SMS	CHICAGO, IL NAPERVILLE, IL SPRINGFIELD, IL	GRANGER, IN GRIFFITH, IN DUBLIN, OH	ST. LOUIS, MO FT. WORTH, TX DENVER, CO	<b>FIGURE 2</b>
<small>REUSE OF DOCUMENTS THIS DOCUMENT, AND THE DESIGNS INCORPORATED HEREON, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF WEAVER CONSULTANTS GROUP, LLC, AND IS NOT TO BE USED IN WHOLE OR IN PART, WITHOUT THE WRITTEN AUTHORIZATION OF WEAVER CONSULTANTS GROUP, LLC.</small>					

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## **TABLES**

**Table 1**  
**Field and Lab QC Sample Requirements**  
**Locomotive Shop**  
**Burns Harbor, Indiana**

QC Sample Type	QC Samples	Frequency of Sample/Analysis	Details
<b>Field Samples</b>	Field Duplicate Samples	1 duplicate per 20 samples per matrix, or 1 duplicate per sample matrix if fewer than 20 samples.	Duplicate sample to be collected by the same methods at the same time as the original sample. Used to verify sample and analytical reproducibility.
	Field Blanks	1 field blank per 20 samples per matrix, or 1 equipment blank per sample matrix if fewer than 20 samples	Laboratory prepared D.I. water blank to assess for potential contamination during sample field collection, containers, preservation, or in laboratory.
<b>Lab Samples</b>	Matrix Spike/ Matrix Spike Duplicate	1 MS/MSD per 20 or fewer samples per matrix	Laboratory spiked sample to evaluate matrix and measurement methodology.
	Method Blanks	1 method blank per batch of samples prepared, or per lab SOP	Laboratory blank sample to assess potential for contamination from laboratory instruments or procedures.
	Laboratory Control Samples and Duplicates	Analyzed as per method requirements and laboratory SOPs	Evaluates laboratory reproducibility.

**Table 2**  
**QA Objectives for Field Measurements**  
**Locomotive Shop Groundwater Monitoring**  
**Burns Harbor, Indiana**

PARAMETER	INSTRUMENT	RESOLUTION	ACCURACY	COMPLETENESS
Water Levels	Solinist Water Level Indicator	0.01 ft.	±0.1 ft	95%
Temperature	Oakton pHTester 20 or 30	0.1°C	±0.15°C	95%
Conductivity	Oakton SCTester	0.1 mS	±1% of full scale	95%
pH	Oakton pHTester 20 or 30	0.01 pH units	±0.2 pH units	95%
DO	Oakton DO+6 meter	0.1 mV	±20 mV	95%

**Table 3 - Sample Container, Preservation and Holding Time Requirements**

Matrix	Analysis	Container	Preservation	Holding Time
Ground water	Volatile Organic Compounds	3 – 40 ml level 2 glass vials	Cool to $\leq 6^{\circ}$ C HCl to pH <2	14 days
	Semivolatile Organic Compounds or PAHs	1 – 1 L level 2 amber glass bottle	Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> if Cl present, Cool to $\leq 6^{\circ}$ C	7 days*

\* Number of days for extraction; 40 days for analysis.

\*\* Waterlogged samples (e.g. riverbed sediment) will have elevated reporting limits. In some instances, one 4-oz glass jar of undisturbed sample may be more appropriate than a standard 4-vial VOC kit.

# **APPENDIX A**

Field Standard Operating Procedures (SOPs)

**FIELD SOP 08-002 (10-17-15)**  
**SUB-SURFACE SOIL SAMPLING**

**1.0 PURPOSE**

This SOP establishes the methods to be used by Weaver Consultants Group (WCG) in obtaining subsurface soil samples for physical or chemical analyses. This SOP covers subsurface soil sampling by split-spoon or direct push sampler, as these are the methods most often utilized for obtaining samples from unconsolidated deposits. This SOP is intended to supplement project specific requirements contained in the Sampling and Analysis Plan (SAP). In the event of a conflict between requirements specified in this SOP and the SAP, the SAP requirements should be followed.

**2.0 EQUIPMENT AND MATERIALS**

Implementation of this SOP will require some or all of the following equipment and materials:

- Appropriate sample containers
- Sample container labels
- Chain of custody forms and chain of custody cooler seals
- Cooler(s) for temporary storage and shipping of samples
- Ice for chilling samples
- Terra Core Kit (for VOCs only) (En Novative Technologies, Inc.) (Use only if within precautionary date)
- Gloves (nitrile for all soil contaminant types, latex for non-oily samples only)
- Stainless steel bowl (approximately 4 quarts) and stainless steel spoon
- Writing instrument (water-proof ink)
- Field notebook
- Rotary drilling rig, augers, rods, and split-spoon or Shelby tube samplers
- Direct-push (e.g. Geoprobe<sup>®</sup>) sampling rig, rods, and Dual Tube or Macro-Core samplers and dedicated liners



### **3.0 METHOD OR PROTOCOL**

#### **3.1 General Procedures**

Subsurface soil sampling typically involves using a drill rig with continuous split-spoon sampling or a Geoprobe® rig with continuous (liner) sampling at each successive interval, although the actual sampling interval will be specified in the SAP. Typically, a laboratory sample and field sample are collected from each split-spoon or continuous (liner) sample for possible future laboratory analysis and on-site headspace screening, respectively. Soil borings drilled using rotary drilling equipment or soil probes advanced using direct-push equipment are typically performed utilizing either a truck-mounted drill rig or an all-terrain vehicle (ATV) equipped with a drill rig or Geoprobe®.

#### **3.2 Specific Procedures**

##### ***3.2.1.1 Soil Sampling with a Split-Spoon Sampler***

The following presents a series of step by step procedures for subsurface soil sampling using a split-barrel sampler and standard penetration test:

1. Subsurface soil samples shall be obtained using a split-spoon (tube) type sampler having a 2 inch outside diameter (O.D.) with a corresponding 1-3/8 inch inside diameter (I.D.) and an 18 inch, 24-inch, 48-inch or 60-inch sample capacity. It may require a flap valve or basket-type retainer for loose soil sampling. Sampling frequency will be continuous, sampling each successive interval, or as otherwise specified in the project scope of work.
2. Samples shall be obtained using the standard penetration test (SPT), which allows for determination of resistance within the deposit. The sampler shall be driven using a 140 pound hammer with a vertical drop of 30-inches. The number of hammer blows required for every six inches of penetration shall be recorded on the boring log.
3. The sampler shall be immediately opened upon removal from the casing. If the recovery is inadequate, another attempt shall be made before drilling progresses. Adequate recovery should be no less than twelve (12) inches, not including any residual wash material brought up with the sample in order to provide sufficient sample volume for logging and possible physical or chemical analysis.

4. Representative samples will be collected for possible future analysis. Be sure to obtain a sufficient quantity of soil for the desired chemical or physical analysis. Each sample will be visually classified by the sample team member and placed in the appropriate laboratory supplied container, labeled, and placed in a cooler.
5. If collecting a soil sample for VOC analysis, use the following SW846 Method 5035 to minimize the loss of VOCs during sample collection as previously described in this SOP.
6. All relevant information will be recorded on the soil boring log form (see **Figure 1** for an acceptable example) and the sample will be classified using the Unified Soil Classification System (ASTM D-2487-69 and D-2488-69).
7. All drilling equipment shall be decontaminated between locations and all sampling equipment between samples, according to the Field SOP 08-006.
8. Proper procedures for delivery to the designated laboratory shall be initiated at the appropriate time interval (i.e. at the end of each day, week, once all samples are collected, etc., while ensuring that the samples will be delivered within the proper analytical holding times).

### 3.2.2 Advancing a Soil Probe with a Geoprobe<sup>®</sup>

The Macro-Core (MC) sampler has an outside diameter of 2.0 inches and comes in four lengths, 4-, 3-, or 2-foot or 1 meter. When using the 48-inch sample tube, the sampler is capable of recovering a core measuring up to 1,300 mL in volume in the form of a 45-inch x 1.5-inch core. The samples are recovered in a liner inserted inside the MC sample tube. Liners are 46-, 34-, or 22-inches long to fit the three sizes of sample tubes, and are 1.75 inches in diameter. Liners are available in stainless steel, Teflon, PVC, and PETG. MC spacer rings are used to attach liners to the cutting shoe. Core catchers also are available to improve sample recovery in some formations. A core catcher can be used to prevent saturated sands and other non-cohesive soils from falling out of the MC sampler as it is retrieved from depth. The following presents a series of step by step procedures for advancing an open-tube and a closed piston soil probe.

#### **3.2.2.1 Continuous Core (Open-Tube) Sampling with a Geoprobe**

1. For continuous coring, a MC core catcher will be attached to the cutting before the cutting shoe is screwed into the sample tube.

2. If a core catcher is not used, the MC spacer ring is attached to the cutting shoe, then the assemble is screwed into the sample tube.
3. The cutting shoe will be securely tightened into the sample tube.
4. A MC liner will be inserted into the sample tube.
5. The MC drive head will be connected to the top of the sample tube.
6. The drive head will be tightened into the top of the sample tube using a wrench.
7. The drive cap will be tightly attached to the drive head.
8. The sampler will be placed in the driving position, parallel to the derrick axis.
9. The sampler will be driven into the ground until the drive head reaches the ground surface.
10. The drive cap will be removed, the pull cap will be attached to the sampler drive head and the sample will be pulled out of the ground.
11. The sampler will be pulled completely out of the hole and the cutting shoe will be loosened.
12. The cutting shoe and filled liner will be removed from the sampler.
13. The sampler will be deconed, reassembled with a new liner, and inserted in the same hole to take the next soil core.

#### ***3.2.2.2 Closed Piston Sampling with a Geoprobe®***

The closed piston system is used to collect representative soil cores from significant depths in soil types due to soil slough. Because of this, the MC sampler can be equipped with a piston which locks into the cutting shoe. This allows the sealed sampler to pass through the slough material and be opened at the appropriate sampling interval. The closed piston system is meant to be inserted through previously opened holes. It is not designed to be driven from the surface through undisturbed materials. All sampler parts should be thoroughly cleaned before assembly and should fit together tightly. A new liner is required for each use if using PETG,

PVC, or Teflon liners for environmental sampling. The Geoprobe® Dual-Tube Sampling System is similar, and may be used in a manner similar to that which is described here.

1. Assemble the piston assembly with the cutting shoe.
2. Slide the assembled piston into the cutting shoe so one-half of the set screw protrudes from under the edge of the cutting shoe.
3. Tighten the piston bolt using a wrench.
4. Place the MC core catcher or spacer ring on the cutting shoe. Thread the cutting shoe into one end of the sample tube.
5. Tighten the cutting shoe assembly onto the sample tube.
6. Insert a MC liner into the sample tube.
7. Connect the drive head to the top of the sample tube.
8. Tighten the drive head into the sample tube.
9. Tightly attach a drive cap to the drive head.
10. Place the leading end of the sampler in the previously opened probe hole.
11. Move the probe unit away from the probe rods, remove the drive cap, and insert a MC release rod down the inside of the probe rods.
12. Couple the release rod to extension rods, adding the jointed rods down hole until the release rod contacts the bottom of the sampler. Attach an extension rod handle to the top extension rod. Rotate the handle clockwise approximately four complete turns. The piston assembly is now released and will move to the top of the sampler as the liner is filled.
13. Remove all extension rods and release rod. Add a probe rod, attach the drive cap to the tool string, and reposition the probe unit. Drive the sampler the length of the sample tube to fill the liner with soil. It is usually best to use the hammer while sampling, even in soft soils. This usually improves sample recovery.
14. Remove the drive cap and attach a pull cap to the probe rods.

15. Pull the rod string and sampler completely out of the probe hole.
16. Loosen the cutting shoe with a vise (if necessary) and wrench.
17. Remove the cutting shoe and filled liner from the sample tube. The sampler is deconed according to project requirements, reassembled with a new liner, and is ready to be inserted to collect the next soil core.

### **3.2.2.3 Soil Sampling with a Macro-Core Liner**

1. Soil samples are recovered in a liner inserted inside the MC sample tube. Liners are 46-, 34-, or 22-inches long to fit the three sizes of sample tubes, and are 1.75 inches in diameter. Samples will be collected in stainless steel, Teflon, PVC, and PETG liners.
2. The liner shall be immediately opened upon removal from the MC sampler. If the recovery is inadequate, another attempt shall be made before drilling progresses. Adequate recovery should be no less than 12 inches, not including any residual wash material brought up with the sample in order to provide sufficient sample volume for logging and possible chemical analysis.
3. Representative samples will be collected for possible future analysis. Be sure to obtain a sufficient quantity of soil for the desired chemical or physical analysis. Each sample will be visually classified by the sample team member and placed in the appropriate laboratory supplied container, labeled, and placed in a cooler.
5. All relevant information will be recorded on the Soil Probe Log Form (see **Figure 2** for an acceptable example) and the sample will be classified using the Unified Soil Classification System (ASTM D-2487-69 and D-2488-69).
6. All drilling equipment shall be decontaminated between locations and all sampling equipment between samples according to Field SOP 08-006.
7. Proper procedures for delivery to the designated laboratory shall be initiated at the appropriate time interval (i.e. at the end of each day, week, once all samples are collected, etc., while ensuring that the samples will be delivered within the proper analytical holding times).

### 3.2.3 Advancing a Soil Boring with a Drill Rig

The following presents a series of step by step procedures for advancing a boring with hollow stem augers (HAS):

1. A hollow stem auger is rigid tubular device fitted with external flights that is advanced by twisting in the borehole to prevent borehole collapse or interzonal communication. The HAS shall be advanced to the required depth according to project requirements. All loose material within the auger stem shall be removed, typically using a split-spoon whose contents are discarded, prior to sampling. Hollow-stem augers or solid flight augers with casing may be used according to specific project requirements as described in the project scope of work. If hollow-stem augers are to be used, the bit shall be equipped with a plug device to be removed at the required sampling depth.

### 3.3 Sample Handling

If collecting a soil sample for physical analysis, containerize the specimen in a standard 8 ounce olive jar or zip top freezer bag.

If collecting a soil sample for chemical analysis, containerize the specimen in the laboratory-supplied container appropriate for the method. Flint glass wide-mouth vials of either 4 ounce or 8 ounce size the acceptable for almost all soil samples.

If collecting a soil sample for VOC analysis, collect the VOC aliquot first and use the following SW846 Method 5035 to minimize the loss of VOCs during sample collection:

- a. Use the provided Terra Core syringe to collect the 5-gram representative samples of soil. If unable to collect the required amount by pushing the syringe into the soil, pull the plunger of the syringe in, and use a scooping motion to fill the 5-gram area of the syringe.
- b. Add a 5-gram sample to each vial in the Terra Core Kit (2 pre-tared with de-ionized water and 1 pre-tared methanol preserved vials provided by the laboratory).
- c. Seal each vial with the screw-cap septum seal and gently swirl the vial to totally immerse the soil in the preservative.

- d. Collect the fourth container in the Terra Core Kit (3 ounce glass jar) for percent solids determination.

Following collection of the VOC aliquot from the undisturbed or relatively undisturbed soil matrix, use the sampling tool to fill the stainless steel bowl with a quantity of soil sufficient for the balance of the sampling containers. Gently mix the soil to homogenize the matrix, and then containerize the rest of the samples in order of decreasing volatility: (1) SVOCs, (2) PCBs, (3) Pesticides, and (4) metals.

Samples collected for laboratory analysis will be placed in pre-cleaned, laboratory supplied containers (jars or bottles) of the appropriate size, according to the analyses to be performed. Each label should have the following information recorded:

- Sample Location – Site where the sample was taken;
- Date - A six digit number indicating the year, month and day of collection;
- Time - A four digit number indicating the military time of collection;
- Sample Number - A unique identification number which may contain the above information, but which distinguishes samples, among those collected from the same site at the same time;
- Preservative - Type, if any;
- Sampler - Name of person collecting the sample;
- Parameters – Parameters for which the contents of the container are to be analyzed.

Quality control (QC) samples (blanks, duplicates, etc.) are labeled as above, but are not identified as quality control samples on the labels. Identify all QC samples in the field notebook.

Once labeled, samples should be placed in a cooler packed with ice, to ensure a constant temperature at or near 4° C, pending submittal to the laboratory for analyses. After each sample has been collected, containerized and labeled, it is entered on the chain-of-custody form. One chain-of-custody form may be used for as many samples as will fit on the form, but all samples sharing a single chain-of-custody form must be packaged and shipped together. The sampler must complete all of the heading information on the form accurately and legibly. For each sample, the following information is entered:

- Sample Number (this identification number must be identical to the identification number on the sample label),

- Date and time of sample collection,
- Type and quantity of sample,
- Number of containers per sample, and
- Analyses to be performed.

Once they have been properly labeled and logged, samples are packaged for shipment and sent to the laboratory with a separate chain-of-custody record sealed into each package. The entire contents of each package must be recorded on the enclosed chain-of-custody record(s); and the samples identified on each chain-of-custody record must be only those contained in the package represented by that record. Sample packaging and shipping will conform to Field SOP08-008. Chain-of-custody protocol is described in Field SOP 08-007.

Before each package is sealed, two chain-of-custody seals are selected, and all of the contents (including the chain-of-custody record) are inside the cooler, it is closed (sealed). The chain-of-custody seal then is affixed to opposite ends of the lid, so that the lid cannot be opened without breaking the chain-of-custody tape. Each chain-of-custody seal is signed and dated by the person sealing the package. Cellophane tape should be affixed over each chain-of-custody seal to protect it from weathering and abrasion. At this stage, the package should be wrapped with clear fiber shipping tape to ensure that it will not open upon transport. The shipping tape should be placed over the chain-of-custody tape so that the package cannot be opened without tearing it.

#### **4.0 DOCUMENTATION**

The following documents will be utilized to ensure that the specific activities performed are appropriately documented:

- Soil Boring/Soil Probe Log Forms
- Sample Labels
- Chain-of-Custody Forms
- Shipping Receipts

Sample labels shall be completed at the time each sample is collected and will include the information listed below.

- Client or project name
- Sample I.D. (number)



- Designation (sampling point identification)
- Analysis
- Preservation
- Sample collection date and time, Sampler's name

A chain-of-custody form is a record of sample collection and transfer of custody. The information listed above must also be entered on the chain-of-custody form (refer to Field SOP 08-007).

A field book will be maintained as an overall log of all events which occur throughout the project, including conditions encountered, samples collected, deviations from the scope of work, unusual circumstances, etc. Each page of the field log book will be initialed by the field personnel making the entry.

All documents are to be retained in the appropriate project files indefinitely or for a period as specified in a project specific data management plan. It is important that all field documentation be as complete as possible to ensure traceability.

The field book will be maintained as an overall log of all samples collected throughout the study. These documents will be retained in the appropriate project files.

## **5.0 APPLICABLE STANDARDS AND REFERENCES**

SW-846 Method 5035

Unified Soil Classification System (ASTM D-2487-69 and D-2488-69)

WCG Field SOP 08-006 (Decontamination of Field Equipment)

WCG Field SOP 08-007 (Chain of Custody)

WCG Field SOP 08-008 (Sample Packaging and Shipping)



<b>Weaver Consultants Group</b> 4085 Meghan Beel CT Bend, IN 46628 271-3447 Tel (574) 271-3343 Fax		South (574)		<b>Soil Probe No.:</b>	
				File No.:	
				Client:	
				Date:	
WATER LEVEL DATA			Time Started:		
Ft While Drilling			Time Completed:		
Ft at Completion			Driller:		
Ft at ___ hours after drilling			Location:		
					Page 1 of _
GROUND ELEVATION:			SAMPLE DATA		
DEPTH (ft)	SOIL DESCRIPTION	RECOVERY (in.)	PID (ppm)	MOISTURE CONTENT	
1.0					
2.0					
3.0					
4.0					
5.0					
6.0					
7.0					
8.0					
9.0					
10.0					
11.0					
12.0					
13.0					
14.0					
15.0					
16.0					
17.0					
18.0					
19.0					
20.0					
NOTES:			Logged by:		

**FIGURE 2**

**FIELD SOP 08-003 (10-17-15)**  
**GROUNDWATER SAMPLING**

## **1.0 GENERAL**

This standard operating procedure (SOP) establishes the methods to be used by Weaver Consultants Group (WCG) personnel for obtaining groundwater samples for chemical analyses. Groundwater sampling locations include water wells, monitoring wells, and temporary wells (i.e., soil boring and soil probe water sampling). This SOP is intended to form a basis for project specific requirements and may be supplemented with specific requirements as listed in the Sampling and Analysis Plan (SAP). In the event of a difference between requirements specified in this SOP and the SAP, the SAP requirements should be followed.

## **2.0 EQUIPMENT AND MATERIALS**

Implementation of this SOP requires some or all of the following equipment and materials:

- Appropriate sample containers
- Sample container labels
- Chain of custody forms
- Cooler(s) for temporary storage and shipping of samples
- Ice for chilling samples
- Gloves (nitrile for all contaminant types, latex for non-oily samples only)
- Writing instrument (water-proof ink)
- Field notebook
- Bailer (dedicated or single-use)
- Bailer cord (polypropylene, polyethylene, or stainless steel)
- Other sampling/purging equipment (i.e. peristaltic pump, submersible pump, check valve pump, etc.)
- Deionized water
- Depth-to-water meter
- Bucket(s)
- Garbage bags

- Groundwater sampling field forms
- Interface probe (when checking for LNAPL or DNAPL)
- Water quality meter(s)
- Filtration apparatus

### **3.0 METHOD OR PROTOCOL**

#### **3.1 General Procedures**

The general procedures to be followed include purging the well prior to sample collection to ensure that a representative sample is obtained from the aquifer for chemical analysis. A number of field measurements are to be recorded during the sampling program (depth-to-water, temperature, pH, etc.).

#### **3.2 Specific Procedures**

The following presents a series of step-by-step procedures for groundwater purging and sampling:

##### *3.2.1 Groundwater Level Measurement*

Groundwater level measurements will be recorded using an electronic or mechanical device, referred to as a “depth-to-water meter”. If separate phase product is, or may be present in the well, an interface probe may be utilized to measure the depth to LNAPL or DNAPL layers. In this case, the depth to all phase interfaces is recorded.

1. Well Security – Unlock and/or open the well.
2. Measuring Point – The measuring point for all water level measurements will be the well rim (top edge of the well pipe, not the protective casing) whose elevation is typically known.
3. Measurement - Lower the clean depth-to-water probe into the monitoring well. Care must be taken to assure that the probe hangs freely in the monitoring well. The water level measuring tape will be lowered into the well until the audible sound of the unit is detected. At this time, the precise measurement should be determined (to one one-hundredth of a foot) by repeatedly raising and lowering the tape to converge on the exact measurement. The water level measurement should be entered on the groundwater sampling field form (**Figure 1** provides an example field sampling form).

4. Decontamination – The depth-to-water meter will be decontaminated immediately after use with a towel by placing it around the tape, and allowing the tape to pass through as it is reeled up out of the well. Only that portion of the tape that enters the well will be cleaned.

### 3.2.2 Purge Volume Computation

To ensure a representative sample from the groundwater aquifer, all monitoring wells must be purged prior to sample collection. The water volume can be computed using the following calculation for a two-inch inner diameter well casing:

$$\begin{array}{l} \text{Volume of Water in 2-inch} \\ \text{Well Casing (gallons)} \end{array} = (\text{TWD} - \text{DTW}) \times 0.163 \text{ gallons/foot}$$

Where:                      TWD = Total well depth (feet)  
                                    DTW = Depth to water measurement (feet)

Note: Factor for 4-inch well is 0.65 gal/ft; 6-inch well is 1.5 gal/ft

Low-flow or “micropurge” sampling will be utilized where practicable. For this method, a specific purge volume need not be achieved. The well will be purged using a pump operating at 100 to 1000 mL minute to keep water level changes to 0.3 ft or less (if practicable). Stabilization will be considered achieved when three consecutive measurements of pH, temperature, specific conductance, oxidation/reduction potential (ORP), and dissolved oxygen (DO), taken at 3 to 5 minute intervals, are within the limits specified for stabilization in **Figure 1**. Regarding ORP and DO, if stability is achieved for either ORP or DO, the flow is considered stable for sampling.

### 3.2.3 Well Purging and Sampling Methods

Purging must be performed for all groundwater monitoring wells prior to sample collection in order that a representative sample is obtained. The following sections explain the proper procedures for purging and collecting water samples from monitoring wells.

The following types of equipment may be used for well purging and/or sampling: a bailer, a peristaltic pump, a submersible pump, a bladder pump, or a check valve inertia pump. In all cases, pH, specific conductance, temperature, and other parameters as specified in the SAP should be monitored during purging in order to determine stabilization of field measurements (i.e. pH, specific conductance, temperature). Field parameter values will be entered on the groundwater sampling field form (see **Figure 1** for an example) along with the corresponding

purge volume. Stabilization of the field parameters will be determined and recorded before containerizing the laboratory samples.

#### *3.2.3.1 Bladder Pump*

Bladder pumps allow the sampler to pump groundwater as it flows through the screened portion of the monitoring well (i.e. low flow purging sampling method). Bladder pumps are generally dedicated pumps that are installed within the screened interval of a well. The control box allows for the sampler to adjust the time allotted for both the refill and discharge cycles, while measuring the drawdown to evaluate whether stagnant water is being introduced into the screened interval. Since bladder pumps are utilized for the low flow sampling method, purging large volumes of water are unnecessary.

1. Start the air compressor. Connect the air compressor hose to the pump control box, and another air hose from the control box to the pump.
2. Turn the control box on. Adjust the pressure, refill cycle, and discharge cycle according to the depth of the pump and the recharge of the well.
3. Monitor the groundwater level and adjust cycles to maintain a consistent groundwater level. If drawdown is occurring, stagnant water is likely entering the screened interval and the timed cycles should be increased to allow for a longer period of time for the well to recharge. Water level drawdown when using a bladder pump for low flow or micro-purging should be kept at 0.3 ft or less. If drawdown exceeds this level, increase the cycle time to reduce the flow of water.
4. After purging the amount of water that is contained in the pump and associated tubing, field parameters will be obtained at three to five minute intervals to monitor for stability. Once three measurements are within the criteria set for stability, groundwater samples may be collected directly from the pump discharge.

#### *3.2.3.2 Bailing*

Bailers are constructed using a variety of materials; generally, PVC, polyethylene, stainless steel, or Teflon. Care must be taken to select a specific type of bailer that meets a project's particular needs. Teflon bailers are generally most "inert" and are used most frequently for groundwater purging. Groundwater monitoring wells generally use a dedicated (used for one well only) bailer for purging. If not, the option to assign dedicated purging bailers should be considered for

further sampling events. The bailer may also be appropriate for sample collection, or a different bailer may be utilized for sample collection. This bailer may also be used solely for sample collection if the well is purged using another form of purging equipment.

1. Obtain a clean/decontaminated bailer and an appropriate length of bailer cord. Using the cord, tie a secure knot through the bailer loop.
2. Raise the bailer by grasping a section of cord using each hand alternately by a “rocking” action. This method requires that the samplers’ hands be kept approximately two or three feet apart and that the bailer rope is alternately looped onto or off each hand as the bailer is raised and lowered.
3. Bailed groundwater is poured from the bailer into a graduated bucket to measure the purged water volume.
4. For slowly recharging wells, the bailer is generally lowered to the bottom of the monitoring well and withdrawn slowly through the entire water column. Rapidly recharging wells should be purged by varying the level of bailer insertion to ensure that stagnant water is removed.

### *3.2.3.3 Surface Pumping*

Groundwater withdrawal using pumps located at the surface is commonly performed with peristaltic or centrifugal pumps. Applications of surface pumping will be governed by the depth-to-groundwater surface. Peristaltic and centrifugal pumps are limited to conditions where groundwater needs only be raised through approximately 30 feet of vertical distance. The lift potential of a surface pumping system will depend upon the net positive suction head of the pump and the friction losses associated with the particular suction line, as well as the relative percentage of suspended particulates. Surface pumping can be used for many applications of well purging and groundwater sample collection.

- **Peristaltic Pump**

Peristaltic pumps provide a low rate of flow typically in the range of 0.02–0.2 gallons per minute (gpm) (75-50 ml/min). Peristaltic pumps are suitable for purging situations where disturbance of the water column must be kept minimal for particularly sensitive analyses. Peristaltic pumps are most often used in conjunction with field filtering of samples and therefore can be used to obtain water samples for direct filtration at the well head.



- Centrifugal Pump

Centrifugal pumps are designed to provide a high rate of pumping, in the range of 10-40 gpm, depending on pump capacity. Discharge rates can also be regulated somewhat, provided the pump has an adjustable throttle.

If a surface pump peristaltic pump is used to purge or sample, the following steps will be employed:

1. Place the suction/discharge line in the peristaltic pump. Peristaltic drive tubing, typically silicone or Norprene, will be used through the pump head due to its ease of decontamination. The remainder of the tubing may be polyethylene or other inert material appropriate for the scope of work. The suction line must be long enough to extend to the static groundwater surface and reach further should drawdown occur.
2. Start the pump and direct the discharge into a graduated bucket of known capacity (typically 5 gallons).
3. Measure the pumping rate in gallons per minute by recording the time required to fill a selected volume of bucket. Flow measurement shall be performed a minimum of three times to obtain an average rate.
4. The pumping shall be monitored to assure continuous discharge. If drawdown caused the discharge to stop, the suction line will be lowered very slowly further down into the well until pumping restarts. If low-flow or micropurge sampling is being implemented, the depth to groundwater level should be monitored during purging. The drawdown in the well being sampled should not exceed 0.3 ft.
5. Measurements of pH, temperature, specific conductance, or other project-specific parameters will be made at timed intervals during well purging, and these measurements recorded on the groundwater sampling field form.
6. Samples will be containerized directly from the discharge tubing unless volatile organic compounds (VOCs) are being analyzed. For VOCs, the "soda straw" variation will be employed. Instead of collecting the sample from the pump discharge, the down-hole tube will be withdrawn from the well and the pump gently reversed to back the water out into the sample container without drawing it through the pump head. The last 0.5 ft of

water will be retained in the tube instead of discharging to the sample container because it is likely to have backed out of the pump head or discharge line.

#### *3.2.3.4 Rotary Pump*

The Grundfos pump system or other electrical submersible pump (a rotary pump system) is an efficient means of purging monitoring wells. They are usually used for monitoring wells that are located in a very permeable aquifer where the recharge time is very fast. These pumps can extract anywhere from 0.5–50 gpm, depending on location.

1. Remove the pump and it's accessories from the protective case, ensuring there is no ground contact to prevent contamination.
2. Connect the electrical wiring to the power source (i.e. electrical generator).
3. Decontaminate the pump prior to collection of each sample as described in Field SOP 08-006.
4. Connect the water discharge line and the pump draw down line to the pump and lower it into the monitoring well below the static water table. Once the pump is in its desirable position, securely fasten the draw down line to secure the pump.
5. Set the pumping speed at a moderate setting to begin and gradually increase until a satisfactory discharge speed is achieved. The discharge speed will depend on the type of aquifer (low–high permeability).
7. Pump and direct the discharge into a graduated bucket of known capacity (typically 5 gallons).
8. Measure the pumping rate in gallons per minute by recording the time required to fill a selected volume of bucket. Flow measurement shall be performed a minimum of three times to obtain an average rate.
9. The pumping shall be monitored to assure continuous discharge. If drawdown caused the discharge to stop, turn the pump off and lower into the groundwater. Resume pumping only if water still exists in the well. Care must be taken to not allow the pump to operate without being submersed in water because this can damage the pump. If low-flow or micropurge sampling is being implemented, the depth to groundwater level should be

monitored during purging. The drawdown in the well being sampled should not exceed 0.3 ft.

10. Measurements of pH, specific conductance, temperature, or other parameters will be made at timed intervals during well purging, and these measurements recorded on the groundwater sampling field form.
11. Samples are containerized directly from the pump discharge.

### **3.3 Sample Collection and Preservation**

Groundwater samples will be collected directly from the sampling device into their respective containers with a minimum of disturbance or exposure to the atmosphere. Sample containers will generally be received from the laboratory pre-preserved. Care will therefore be taken not to overfill or rinse the preservative from its sample container while filling the container. Groundwater sample aliquots to be analyzed for VOCs will be collected first. VOC sample vials will be gently filled using the side-fill technique. If bubbles form in the VOC vials after they are sealed, new vials will be attempted. If bubbles persist, unpreserved vials will be filled and noted on the field log and chain-of-custody form. The balance of the sample aliquots will be collected in order of decreasing volatility as follows: (1) SVOCs, (2) PCBs, (3) Pesticides, and (4) metals and other inorganic parameters.

Prior to sample transport or shipment, groundwater samples may require filtration and/or preservation dependent on the specific type of analysis required. Specific preservation techniques are described in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Third Edition, Update III*. A project-specific scope of work will be prepared outlining the necessary procedures, and shall be utilized during field effort.

Groundwater samples collected for dissolved metals analyses may need to be filtered prior to being placed in sample containers. Groundwater filtration will be performed using a sampling pump to drive the water through a 0.45µm filter cartridge manufactured specifically for groundwater sampling. A QED models FF8100 and FF8200 are examples of acceptable filtration cartridges. The filters to be utilized are disposable and should be used for one sample only.

The filtration of groundwater samples shall be performed either directly from the monitoring well or from intermediate sample containers provided by the laboratory. In either case, fresh groundwater should be filtered and discharged from the filtration apparatus directly into sample container for dissolved parameter analyses, pH adjustment of the sample may also be required.

This is generally accomplished through utilization of laboratory supplied sampling containers with preservative appropriate for the parameters being analyzed for.

### **3.4 Sample Handling**

Samples collected for laboratory analysis will be placed in pre-cleaned, laboratory supplied containers of the appropriate size, according to the analyses to be performed. A label will be affixed to each container with the following information:

- Sample Location – Name of the place where the sample was taken;
- Date - A six digit number indicating the year, month and day of collection;
- Time - A four digit number indicating the military time of collection;
- Sample Number - A unique identification number which may contain the above information, but which distinguishes samples, among those collected from the same site at the same time;
- Analytical parameters for the container;
- Preservative - Type, if any; and
- Sampler - Name of team member collecting the sample.

All observations (visual description, odor, sample time and date, etc.) should be recorded on the appropriate form or in the field book.

Quality control (QC) samples (blanks, duplicates, etc.) are labeled as above, but are not identified as quality control samples on the labels. Identify all QC samples in the field notebook.

Once labeled, samples should be placed in a cooler packed with ice, to ensure a constant temperature of  $4^{\circ} \pm 2^{\circ}$  C, pending submittal to the laboratory for analyses. As soon as each sample has been collected, containerized and labeled, it is entered on the chain-of-custody form according to Field SOP 08-007. One chain-of-custody form may be used for as many samples as will fit on the form, but all samples sharing a single chain-of-custody form must be packaged and shipped or delivered together. The sampler must complete all of the heading information on the form accurately and legibly. For each sample, the following information is entered:

- Sample Number (this identification number must be identical to the identification number on the sample label)
- Date and time of sample collection

- Type of sample
- Number of containers per sample
- Analyses to be performed

Once they have been properly labeled and logged, samples are packaged for shipment and sent, picked up by a laboratory representative, or delivered to the laboratory with a separate chain-of-custody record sealed into each package or shipment. The entire contents of each package must be recorded on the enclosed chain-of-custody record(s); and the samples identified on each chain-of-custody record must be only those contained in the package represented by that record.

#### **4.0 DOCUMENTATION**

The following forms or forms containing the same information will be utilized to ensure that the specific activities performed are appropriately documented:

- Groundwater Sampling Field Form (**Figure 1**)
- Sample labels
- Chain-of-custody form (refer to Field SOP 08-007)
- Field Note Book

A chain-of-custody form is a record of sample collection and transfer of custody. The information listed above must also be entered on the chain-of-custody. In addition, the following information should accompany samples:

- Sample collector's name, company, mailing address and telephone number, analytical laboratory's name, mailing address and telephone number,
- Quantity of each sample, Date of shipment, Description of sample.
- The chain-of-custody forms provide specific locations for entering the above information.

A field book will be maintained as an overall log of all events which occur throughout the project, including conditions encountered, samples collected, deviations from the scope of work, unusual circumstances, etc. Entries to the field note book will be dated and signed by the field personnel making the entry.

All documents are to be retained in the appropriate project files indefinitely or for a period as specified in a project specific data management plan. It is important that all field documentation be as complete as possible to ensure traceability.

## **5.0 APPLICABLE STANDARDS AND REFERENCES**

Weaver Boos Field SOP 08-006 (Decontamination of Field Equipment)

Weaver Boos Field SOP 08-007 (Chain of Custody)

# WEAVER CONSULTANTS GROUP

## GROUNDWATER FIELD DATA SHEET

Site Name: \_\_\_\_\_ Sample Date: \_\_\_\_\_  
 Purpose For Sampling: \_\_\_\_\_ File Number: \_\_\_\_\_  
 Well I.D.: \_\_\_\_\_ Sample I.D.: \_\_\_\_\_  
 Total Depth (Top of PVC): \_\_\_\_\_ ft. Water (Top of PVC): \_\_\_\_\_ ft. Water Column \_\_\_\_\_ ft.  
 PVC Elev: \_\_\_\_\_ ft. (NGVD) Groundwater Elev: \_\_\_\_\_ ft. (NGVD)  
 Weather Conditions: Sunny Partly Cloudy Cloudy Temp \_\_\_\_\_ Wind \_\_\_\_\_  
 Time Purged: From: \_\_\_\_\_ To: \_\_\_\_\_ Well Diameter: \_\_\_\_\_ in.  
 Max Purge Rate: \_\_\_\_\_ mL/min Volume Purged: \_\_\_\_\_ L.  
 Avg Purge Rate: \_\_\_\_\_ mL/min Purge Device/Sample Device: \_\_\_\_\_  
 Time Sampled: From: \_\_\_\_\_ To: \_\_\_\_\_  
 Sample Appearance: \_\_\_\_\_

Laboratory	Container	Container		Field	Head
Analysis	Size	Type	Preservative/Type	Filtered	Space

Measurement ID* (3-5 minute intervals)	Time of day	Water Level (Top of PVC)	pH (SU) (+/- 0.1 SU)	Sp. Cond. (µS) (+/- 3%)	Temp (°C) (+/- 3%)	DO (mg/L) (+/- 3%)
1						
2						
3						
4 (optional)						
5 (optional)						
6 (optional)						
7 (optional)						
8 (optional)						
9 (optional)						
10 (optional)						

Signature of Sampler: \_\_\_\_\_  
 Field Team Members: \_\_\_\_\_  
 Remarks: \_\_\_\_\_

\*Purge at 100 to 1000 mL minute to keep WL changes to 0.3 ft or less. Stabilization will be considered achieved when three consecutive measurements, taken at 3 to 5 minute intervals, are within the limits specified above for all parameters. If greater than 10 measurements are required, record on separate sheet of paper.



**Attachments:**

Figure 1 – Proposed Piezometer Locations, Potentiometric Surface (5/29/2016)  
Figure 2 – Proposed Piezometer Locations  
Table 1 – Field and Lab QC Sample Requirements  
Table 2 – QA Objectives for Field Measurements  
Table 3 – Sample Container, Preservation and Holding Time Requirements  
Appendix A – Field Standard Operating Procedures (SOPs)